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ABSTRACT

This paper describes the non-standard method that was used to evaluate the various processes and procedures employed by more than 20 PLATO courseware development groups and to evaluate this method. The method used was the Flanagan's critical incident technique, modified to include decisions as well as incidents. Sources of information for the evaluation included personal accounts of a number of staff members, interviews with other staff members, and papers and reports. More than 125 case histories of critical incidents or decisions were classified, and the processes and procedures that led to successful, unsuccessful, or equivocal results were analyzed. Discussion of this evaluation method includes its limitations, time requirements, advantages, suggestions for improvement, and its utilization. (VT)

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CRITICAL DECISIONS: AN EVALUATION OF A CAI EVALUATION

by

Esther R. Steinberg

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Critical Decisions: An Evaluation of a CAI Evaluation

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The purpose of this presentation is two-fold: (1) to describe the non-standard method that was used to evaluate the various processes and procedures employed by more than 20 PLATO courseware development groups, and (2) to evaluate this method. For ease of presentation, the method is described in the context of the PLATO system. However, it will become obvious later that is has more general application.

The Evaluation Method

Background. When people first started to write lessons for PLATO, they had to do so without the benefit of other people's experience. Computer-assisted instruction (CAI) was a new technology, so there was little or no literature about CAI. PLATO had unique and novel characteristics, so that research in related areas, such as programmed instruction, was not entirely adequate. Further, decisions had to be made not only about instructional design, but also about project organization and management, where there were even fewer guidelines on which to base decisions. Directors could not even anticipate all aspects of planning that would be necessary.

Each courseware development group using the PLATO system is able to enjoy complete autonomy because of the system's flexibility. Each group makes its own decisions about curriculum, educational philosophy, staff selection, group organization and management. Consequently, the groups using PLATO varied widely in the decisions they made. But they were also different in other ways, such as target population and scope of project. These very different groups sometimes made similar decisions about an effective way to

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improve their project. For example, in at least three different cases, the project director hired a senior programmer to serve as a consultant for beginning authors on his staff. The consultant helped them over difficulties much more quickly than they could have done on their own, and lesson development was expedited. Sometimes, when confronted with similar situations, group leaders chose different alternatives. For example, some decided to develop new curricula for CAI while others adapted available materials.

An evaluation of these experiences was needed to serve as a guide for new groups who would be developing PLATO courseware and as an information resource for existing groups. Little information of this kind was available. The papers and reports that had been generated included such varied materials as catalogs of lessons, student performance data, terminal and lesson usage, attitude questionnaires, and sometimes even cost analysis. However, most provided no data about the evolution of project procedures. Those documents which did include some information of this sort tended to be incomplete and were prone to omit decisions or incidents that produced negative results. Sometimes they reported only on the current phase of a project and omitted earlier work. Nor did historical descriptions fulfill the need. They were, perhaps, interesting, but did not separate the significant events from the insignificant. External evaluators reported on some aspects of project development. But, their work was limited to their particular focus (House, 1973; Mahler et al., 1976).

In response to the general need for such procedural information and the particular interest of the Advanced Research Projects Agency in the outcomes of decisions of PLATO projects, an evaluation was designed and implemented.

Purpose. The purpose of the evaluation was to generate a data base for developing guidelines for future projects. It was "....to provide a broad-based set of case histories and decisions that were observed to have specific effects or long-term impact on the smoothness of project implementation." It also was to be "... a first approximation to a taxonomy of factors that should be considered in project management and

instructional design" (Steinberg, 1977). Like Walberg's (1973) transactional evaluation, its purpose was to emphasize procedures and processes, rather than end products.

Definitions and criteria. At the suggestion of Allen Avner, the starting point was a paper by Flanagan (1954), entitled, "The critical incident technique." There was a strong parallel between the goals of the PLATO evaluation and Flanagan's work. His purpose was to describe the essential characteristics of the work of air force pilots so that job specifications could be formulated and appropriate training programs developed. (He later extended his work to non-military jobs.) The purpose of the PLATO evaluation was to describe essential decisions that were made in the evolution of courseware development in order to produce management and instructional design guidelines. Flanagan defined an incident as critical if its purpose was clear and the results definite enough to "...leave little doubt concerning its effects." His technique was to gather the facts, classify the incidents by inductive reasoning, and infer practical procedures. Flanagan reported some selective bias due to faulty memories, varied perspectives depending on the role of the observer, and some lack of objectivity.

Although Flanagan's technique was an appropriate beginning for the PLATO evaluation study, its definition and scope were too narrow to encompass all aspects of PLATO courseware development. In addition to observable incidents, non-observable events, such as decisions, frequently played a fundamental role in project achievements. Therefore, I broadened the definition to include decisions as well as incidents. Moreover, there were other kinds of events that met the goals of the study but which were not encompassed by this narrow criterion. For example, specific effects or results in some PLATO projects could be attributed to the absence of a decision. A success or failure was sometimes observed to be a consequence of the decision that a project leader made when faced with several choices. There were instances of success which were the result of an evolutionary process or series of events, rather than a single incident.

Thus four criteria were established and an incident or decision was

included in the evaluation if it met at least one of them:

1. the circumstances surrounding a decision or incident were clear, and the effects definite;
2. the project results could be traced to the fact that a leader had failed to make a particular decision;
3. situations in which a choice that was made between alternatives ultimately had a decided advantage or disadvantage; and
4. a scheme or decision that was successful, and had evolved over time through repeated iterations of situation-decision-effect cycles.

Resources. There were three sources of information. The first was my own personal accounts and those of six colleagues, Allen Avner, Eileen Call-Himwich, Larry Francis, Alec Himwich, Joseph Klecka, and Lynn Misselt. The PLATO experience of the group members varied from four to 16 years and included just about every phase of project development, such as lesson writing, author training, observing, consulting, interviewing personnel and evaluation. Each had participated in one or more projects with diverse student populations and subject matter. The second source was the result of interviews with twelve other staff, representing nine additional projects and different levels of responsibility. Twenty papers and reports constituted the third source of information about the projects studied.

Procedure. The initial thrust was a series of informal meetings with my six colleagues. Case histories which came to mind immediately were discussed. This initial set of incidents provided a basis for formulating the definitions and criteria noted above. The incidents were then classified, and this in turn led to an outline of categories. Once the criteria were defined, and the topics generated, they were used as a guide at subsequent meetings of the group, to clarify earlier case histories and to inspire new ones. I held interviews with staff members of other projects, in groups of two to four people and also reviewed available project reports, reading for critical decisions and incidents. Finally, all of the case histories were screened for meeting the criteria, and then incorporated into the classification scheme. In some instances, new categories were added and the classification reorganized. In those instances where an incident fit

equally well in two categories, it was included in both places.

Finally, the findings in each major category were summarized, and background material was written in order to put the results in proper perspective. This was done because some of the results may have seemed to be nothing more than common sense. But what may be obvious in hindsight was not so clear or even visible in foresight.

Product. The evaluation product is a report with three major features. First, it contains more than 125 case histories of critical decisions or incidents. Each history includes not only the decision or incident, but the circumstances surrounding it, and its effect. Where applicable, an epilog describes subsequent events. An example is Case 2A1.3, under the general topic of instructor acceptance and cooperation.

> "In one large curriculum project the director decided to put curriculum management under computer control. That is, the computer kept a complete record for each student and on that basis decided which lesson to present next. The instructors were unfamiliar with the lessons and the hardware. Although they had the option of overriding the computer and setting up their own sequence, they rarely exercised it. They viewed the CBE materials as a separate entity and not an integral part of the regular curriculum.
>
> Epilog. In subsequent years, the decision was made to abandon computer management and to give that responsibility to the instructors. By that time they were more familiar with both the lessons and the system. They had to do much more work, diagnosing and prescribing lessons for each student. However, it gave them a sense of power and control over the machine, and they had more students do more lessons than in previous years. The students, in turn, were more interested because the lessons were more appropriate and the teacher showed a vital interest and participated actively." (Steinberg, 1977, p. 6)

The second feature of the report is that the table of contents is effectively a taxonomy of topics that are the subjects of critical

decisions in the implementation of CAI. They cover a wide range of considerations, such as introducing CAI to an institution that will use it, selection of courseware development staff, the director's role, models of organization, lesson design, use of peripheral equipment, implementation and integration of CAI, evaluation and maintenance. Finally, the report summarizes and analyzes the processes and procedures that led to successful, unsuccessful, or equivocal results.

Evaluation of the Critical Decisions Method

Limitations. A number of the limitations of the Flanagan method were also foreseen for the present one. It was possible to partially compensate for these anticipated problems. First is the problem of case history accuracy. It is well known that people differ in their perspectives of a situation and in their reports. For example, I recall visiting the classroom of one of my children along with some other parents. Comparing impressions as we left the room, I commented that the teacher was very skillful at individualizing the instruction. She had set up four or five science activity centers and allowed the children to choose the one they would work at. The other mother's reaction was that the teacher was terrible, because the children were not quiet and there was some noise in the classroom. Care was taken to minimize this kind of bias in the case histories by obtaining accounts of the same event from more than one source wherever possible: from individuals who had different responsibilities, or from a participant and an observer, or an external report and an active participant.

A second difficulty with the method as implemented here is that it was done after the fact. The problem here is that memory is selective. People sometimes forget the circumstances that led to a decision. They may recall the more dramatic events and forget the ordinary, or those that had a negative effect. This bias, too, was partially overcome by the procedure of obtaining multiple accounts of a single incident. The structured interviews were of some help too. For example, if other sources had only turned up one case to elucidate a topic, such as how PLATO was introduced to the institution, the interviewees were asked specifically to try to recall events related to that topic.

A third difficulty was that the sample of projects may not have been representative. The study was executed after some of the projects had ended and their staff had dispersed. Case histories of these earlier, or smaller projects may not have been adequately represented.

Time. The evaluation took about half of my time for at least six months. Some of the circumstances surrounding the decisions were extremely complex and required repeated interviews to probe for the exact information that was relevant to the observed result. Weekly group meetings with my colleagues absorbed a considerable number of person-hours. But they had the advantage of jogging people's memories of critical events and providing a forum for thrashing out differences of opinion about what really happened and accurately reconstructing the incidents. Early sessions were unstructured and some of the incidents and decisions they produced were later omitted from the evaluation report because they did not meet the criteria. Subsequent meetings were patterned after the interviews with other staff, and produced more explicit information and a greater proportion of suitable incidents.

Advantages. There were at least three important contributions that derived from this evaluation approach. First is generalizability. An analysis of several similar situations should provide a more reliable basis for decision making than a single event. Furthermore, the documentation of the context in which the events occurred enables the reader to decide whether the results might be applicable in his case. The credibility is highest where both positive and negative instances are available. For example, when PLATO was first introduced to an institution, it was enthusiastically received in cases where special efforts were made to engender good will and to orient instructors; but when no such effort was made, there was some resistance.

The report also provides a vehicle for transmitting experience, from one group to another, as well as to novices. Although meetings can be, and have been held to exchange information, the proceedings are not always recorded for written dissemination, and the information is usually not so well

organized as in an evaluation.

Finally, in a relatively new field, it is not always possible to anticipate the kinds of decisions that will have to be made or matters that will have to be considered. The results of this study enable the leader of a new project to plan more accurately, and therefore to implement a more efficient program than would otherwise be possible.

Suggestion for improvement. Bias due to selective representation and distorted memory can be further overcome if critical decisions are documented during planning and development as well as after a program has been completely implemented. Obviously, it is not always possible to anticipate which decisions will be critical and which will have direct long term impact. Nevertheless, I propose some categories as a guide. Edwards and his colleagues (1975) note four sources of change that take place as a program develops: changes in program objectives, changes in program character, changes in the societal or educational needs that spawned the program, and changes that result from the accumulation of knowledge and experience. These sources of change can represent an initial set of topics for documenting decisions and incidents and the circumstances surrounding them at the time they occur. Descriptions of incidents should have multiple authors, to represent different perspectives.

Utilization. Francis (1977) drew heavily on this report to write a management manual to guide directors of CAI sites. An instructional design manual by Call-Himwich and Steinberg (1977) also used the report as a resource. The critical decisions report was published so recently that it is too soon, at the time of this writing, to know how extensively it is being used by others, and who is using it.

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